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Equality and Equity in Compensation *

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Abstract

Equity compensation is widely used for incentivizing skilled employees, particularly in new technology businesses. Traditional theories explaining why firms offer equity suggest that workers with higher rank should receive compensation packages more heavily weighted in equity. However, we observe the puzzle that many firms adopt an *equality-in-equity* strategy: they offer different cash salaries across all jobs but the same equity compensation. We propose a behavioral theory of *domain-contingent inequality aversion* to explain this finding: we argue that workers view salary and equity as two domains and are more inequality averse in the equity domain. Inequality in equity has a negative asymmetric effect on effort whereas the effect of inequality in salary can be positive. Our experimental findings are consistent with the existence of domain-contingent inequality aversion; we also find that inequality aversion in equity is more severe than in salary because of the perceived scarcity of equity.

JEL Classification Codes: D03, C91, C92, J31, J33, M13, M52, M55

Keywords: Inequality Aversion, Compensation, Stock Options, Equity, Scarcity, Experiment

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1 Introduction

Human capital is the most critical asset of modern technology and service firms (Bresnahan et al., 2002; David et al., 1998; Machin and Van Reenen, 1998). Compensation structures incentivize performance and facilitate the hiring and retention of skilled employees and managers (Cappelen et al., 2016; Larkin and Leider, 2012; Lazear, 2000). Compensation packages may include a combination of direct salary, starting bonuses, end-of-year performance bonuses, equity grants or stock options, and non-pecuniary benefits (e.g., free food, gym membership, etc.). Recent research reveals that cash-based performance pay has fallen out of favor for innovation production employees (Ederer and Manso, 2013). Instead, risk-bearing compensation schemes, such as equity grants and stock options, have gained popularity in many industries, especially in the computer, software, internet, telecommunications, and networking fields (Anderson et al., 2000; Frye, 2004; Ittner et al., 2003; Sesil et al., 2007).

Despite this shift in recent decades toward equity plans to reward high-skilled labor, particularly among technology startups, there is little consensus on how equity should be allocated among employees with different ranks or functions. Research has been limited to within-firm equity distribution, and the few existing studies mainly focus on the equity split among top management or founders (e.g., Breugst et al., 2015; Ensley et al., 2007; Hellmann and Wasserman, 2016). In particular, when equity compensation is used in conjunction with cash salary, traditional theories for firms' motives of offering equity, which include retaining talent (Fama, 1980), easing liquidity constraints (Myers and Majluf, 1984), and incentivizing performance (Jensen and Meckling, 1976), suggest that workers with higher rank or more important function should receive compensation packages more heavily weighted in equity.

However, our empirical analysis of 4,744 compensation packages offered by 1,034 firms from AngelList, a popular, online startup job-posting site in the startup technology sector, fails to find evidence for a pattern predicted by these traditional theories. Instead, we document that 22% of firms adopt an *equality-in-equity* strategy, i.e., they offer potential employees the same levels of equity compensation but different cash salaries across different job ranks and functions.¹ Within a firm that adopts the *equality-in-equity* strategy, when a higher ranking job receives higher salary

¹The analysis is documented in [Appendix A](#).

but the same equity as a lower ranking job, the compensation package for the higher ranking job is more heavily weighted in salary, contrary to traditional theories.

Our finding of compression in equity compensation but not in cash salary is surprising for two reasons. First, existing studies of firm benefits of equitable compensation have focused solely on pay to employees with the same job description (Roth and Xing, 1994; Roth et al., 2006) or same productivity levels (Clark et al., 2010). For workers performing at different productivity levels, experimental evidence so far does not support gains from compensation compression (Charness and Kuhn, 2007).

Second, existing theories on the advantages of compensation compression do not distinguish between different forms of pay (Akerlof and Yellen, 1988, 1990; Frank, 1984; Levine, 1991). Moreover, few studies investigate how equality in one type of compensation may produce different effects from equality of another compensation. Yet, anecdotal evidence suggests that individuals may dislike outright equality in salary with their coworkers² while equality appears to be more acceptable in equity allocation. Joel Spolsky, the co-founder and CEO of the portfolio company Stack Exchange, asserts, “Fairness, and the perception of fairness, is much more valuable than owning a large stake,” and he claims that equity should be “split equally among everyone in the layer” where the layer only refers to time of joining the firm.

Motivated by the empirical puzzle of an asymmetric compression in equity and salary, we aim to shed light on two questions: Do workers have distinct preferences for equality in equity versus equality in salary? If so, what are the mechanisms driving the different equality preferences? In this paper, we propose a novel behavioral theory of *domain-contingent inequality aversion*.³ Inspired by the notion of inequality aversion (Fehr and Schmidt, 1999), we argue that workers dislike inequality and their preferences may differ depending on the type of compensation. The established construct of inequality aversion stems from behavioral observations that individuals are concerned about their social standing and economic payoffs relative to others (Bracha et al., 2015; Bolton and Ockenfels, 2000; Charness and Grosskopf, 2001; Clark and Oswald, 1996; Marr and Thau, 2014), and they

²Rachel Sugar, “A CEO raised his company’s minimum wage to \$70,000 a year, and some employees quit because of it,” *Business Insider*, July 31, 2015, <http://www.businessinsider.com/>.

³“Domain” typically refers to the context of decision-making when it appears in the discussion of context-dependent risk preferences (Bonem et al., 2015; Weber et al., 2002) and social preferences (Bao and Ho, 2015; De Oliveira et al., 2009). Furthermore, Schoemaker (1990) uses the phrase “payoff domain” to distinguish gains from losses in monetary outcomes. In our theory, “domain” refers to the payoff form, and more specifically equity versus salary, which can be a particular context for social preference to take place.

prefer equality under certain circumstances.⁴

Our concept of domain-contingent inequality aversion extends the basic theory by postulating that workers view cash salary and equity compensation as distinct domains that impact individual inequality aversion differently, that is, employees may dislike inequality in formal equity ownership more than inequality in cash salary.

We incorporate domain-contingent inequality aversion into a theoretical model to derive the results for workers' effort choices. We show that inequality in equity has a *negative asymmetric effect* on effort while inequality in salary, under some circumstances, may have a *positive asymmetric effect* on effort. The negative asymmetric effect of inequality in equity distinguishes the domain-contingent inequality aversion model from standard models of inequality aversion.

Furthermore, we hypothesize that domain-contingent inequality aversion is driven by the perceived scarcity of equity, and the negative asymmetric effect of inequality in equity is only present when equity is presented as scarce. Most firms have a limited amount of equity—a set percentage of the firm in their options pool—to distribute,⁵ and employees may then perceive equity rewards as a scarce commodity.⁶ Research has shown that scarcity can induce higher consumer preference (Balachander et al., 2009). While few works in economics link a scarcity bias and social preferences, Hegtvedt (1987) and Efron and Miller (2011) have found that people are less selfish with respect to distributions when rewards are scarce. Hence, we hypothesize that equality in equity ownership matters more to workers than equality in cash salary because equity is perceived as scarce. Finally, we discuss the implications of domain-contingent inequality aversion for firms by assuming that management takes such worker preferences into account and optimizes their compensation strategies over an entire group of employees. We argue that, in the presence of a negative asymmetric effect of inequality in equity and a positive asymmetric effect of inequality in salary, the *equality-in-equity* strategy is optimal for firms with a fixed equity compensation budget.

To test our model predictions and hypotheses, we conduct an experiment to determine whether a domain-contingent inequality aversion exists and whether such worker preferences are driven by

⁴Mohnen et al. (2008) find that inequality aversion can lead to peer pressure in teams when individual contribution to the team is transparent. Bellemare et al. (2008) find that there is strong aversion to inequality at other's disadvantage using a representative sample from the Dutch population, and that such aversion rises with age and falls with education level.

⁵The creation and issuing of additional options beyond the existing options pool are costly to prior employees because the new options dilute their percentage ownership of the firm.

⁶"Equity Compensation in An Era of Scarcity", *Solium Capital*, accessed November 26, 2016.

equity scarcity. In a within-subject design, participants experience 7 scenarios of group production with different compensation schemes that mimic salary and equity. We complement the experiment with a between-subject design to test whether the mechanism of equity scarcity drives domain-contingent inequality aversion. In the control group, participants view equity in a non-scarce format, i.e., experiment points. In the treatment group, participants view equity in a scarce format, i.e., as a percentage. Our experiment offers evidence for the existence of domain-contingent inequality aversion, and further finds evidence that inequality aversion in equity is more severe because of a perceived scarcity of equity instead of cash.

This paper makes several contributions. First, motivated by an empirical phenomenon in the high-risk, high-growth startup setting, we propose a behavioral theory of *domain-contingent inequality aversion*, which represents a new consideration for the labor economics and management literature on the subject of employee incentive compensation and its link to individual utility⁷ and firm performance⁸. We are the first to highlight the distinction between inequality in equity compensation and inequality in salary compensation. Second, we provide experimental results for how individuals respond to intra-group compensation distributions when different types of payoffs are used simultaneously. Using output share to mimic equity and flat payment to mimic salary, we are also the first to test experimentally how compression in output share affects individual contribution when flat payment is present and when the value of the share is uncertain. Third, we shed light on the mechanism of domain-contingent inequality aversion by linking scarcity bias and social preferences. Fourth, as equity is becoming increasingly a popular form of compensation in innovation industries, our findings have practical implications, particularly for technology startups, for the optimal allocation of equity among their high-skilled employees.

The paper proceeds as follows. [Section 2](#) presents our theoretical model of domain-contingent

⁷From the worker’s viewpoint, theory has mainly looked at how compensation distribution affects utility ([Fehr and Schmidt, 1999](#)). Empirical results using proxies for utility have been mixed. For example, [Clark and Oswald \(1996\)](#) suggest that equality increases reported job satisfaction, but [Charness and Grosskopf \(2001\)](#) find that reported happiness does not respond to equality.

⁸From the firm’s viewpoint, theoretical work has suggested that firms with less variance in compensation will have more harmonious labor relations, thus leading to more worker effort and output ([Akerlof and Yellen, 1988, 1990](#)), and that narrowing within-firm wage dispersion can increase cohesiveness and workplace productivity ([Levine, 1991](#)). Some have noticed that disparities in pay may induce discontent among employees and result in uncooperative and unaccommodating work behavior ([Pencavel, 2012](#)). However, empirical evidence so far on the effect of equality on aggregate performance is not optimistic. Earlier experimental work finds negative consequences for team performance when agents are paid equal shares of the team’s output ([Isaac and Walker, 1988](#); [Nalbantian and Schotter, 1997](#)), and more recent study does not support the proposition that worker effort responds to coworkers’ wages ([Charness and Kuhn, 2007](#)).

inequality aversion. [Section 3](#) lays out the experimental design and [Section 4](#) discusses the results. [Section 5](#) concludes.

2 Theoretical Model

We present a model of domain-contingent inequality aversion that builds upon a standard group production model with stochastic output and convex cost function ([Nalbantian and Schotter, 1997](#)) but adopts a different stochastic form. Adapting the fairness model of [Benjamin \(2015\)](#), we assume inequality aversion of the form in [Fehr and Schmidt \(1999\)](#). Under domain-contingency, we write distinct functions for inequality aversion in salary and inequality aversion in equity. We employ this model to explain existing empirical observations and generate further hypotheses that we test experimentally.

2.1 Model Setup

We consider two risk-neutral⁹ workers $i \in \{1, 2\}$ in a firm engaged in a group task with output \tilde{V} exerting effort e_i with homogeneous cost function $C(e_i) = e_i^2$.¹⁰ The individual payoff consists of a salary x_i and an equity payoff y_i which is a share of the group output \tilde{V} . The group production process is a binary lottery where

$$\tilde{V} = \begin{cases} V, & \text{with probability } p(e_1 + e_2) & \text{Group "Succeeds"} \\ 0, & \text{otherwise.} & \text{Group "Fails"} \end{cases}$$

assuming $p(e_1 + e_2) = k(e_1 + e_2)$ with $k > 0$.¹¹ The value of equity is $y_i \tilde{V}$ for share y_i .

Without loss of generality, we consider the problem from the perspective of worker $i = 1$. Given compensation structure x_1, x_2, y_1, y_2 and worker 2's effort choice e_2 , the problem faced by worker 1 is

$$\max_{e_1} \mathbb{E}u(e_1; e_2, x_1, x_2, y_1, y_2) = p(e_1 + e_2) \cdot u_{\text{Success}} + [1 - p(e_1 + e_2)] \cdot u_{\text{Failure}} \quad (1)$$

⁹Risk neutrality is an appropriate simplifying assumption for deriving predictions to be tested in a laboratory setting since people are approximately risk neutral when stakes are small (as is in the lab) according to the expected-utility theory.

¹⁰We choose this specification for model tractability and also for a convex cost function.

¹¹We choose this linear specification for model tractability and also for a concave probability function

$$\text{where } u_{\text{Success}} = x_1 + y_1 V - C(e_1) - (D_X + D_Y), \text{ and} \quad (2)$$

$$u_{\text{Failure}} = x_1 - C(e_1) - D_X. \quad (3)$$

D_X represents the worker's inequality aversion in the salary domain and has the form

$$D_X = \alpha_x \left(\max\{(x_2 - C(e_2)) - (x_1 - C(e_1)), 0\} \right) \quad (4)$$

$$+ \beta_x \left(\max\{(x_1 - C(e_1)) - (x_2 - C(e_2)), 0\} \right). \quad (5)$$

α_x is the degree of inequality aversion in salary when the worker is in a disadvantageous position, i.e., having lower utility than the other worker in the salary domain, and β_x denotes the degree of inequality aversion in salary when the worker is in an advantageous position, i.e., having higher utility than the other worker in the salary domain.

The variable D_Y represents the worker's inequality aversion in the equity domain when the group "succeeds" and takes the form

$$D_Y = \alpha_y \left(\max\{(y_2 - y_1)V, 0\} \right) + \beta_y \left(\max\{(y_1 - y_2)V, 0\} \right). \quad (6)$$

D_Y only appears when the group succeeds, as group output and value of equity is zero when the group fails. α_y is interpreted as the degree of inequality aversion in equity when the worker is in a disadvantageous equity position, and β_y denotes the degree of inequality aversion in equity when the worker is in an advantageous equity position.

In the model, we assume all workers are self interested, and thus are more inequality-averse when they are in the disadvantageous position than when they are in the advantageous position ($\alpha_x > \beta_x, \alpha_y > \beta_y$). We also assume that both disadvantageous and advantageous workers are averse to inequality, but only to an extent: the disutility caused by inequality cannot exceed the value of such inequality ($1 > \alpha_x, \alpha_y, \beta_x, \beta_y > 0$). Finally, both disadvantageous and advantageous workers are more averse to inequality in equity than to inequality in salary ($\alpha_y > \alpha_x, \beta_y > \beta_x$).

2.2 Implications for the Worker

Let the utility-maximizing effort of worker i be denoted by e_i^* . Without loss of generality, we focus on e_1^* . We first examine how the compensation package (salary and equity) of worker 1 and the package of the other worker affect worker 1's equilibrium effort choice. These are standard results and are left to the Appendix (see Propositions B.1-B.3). Following Benjamin (2015), we derive our key results in Propositions 1-2 which predict how workers respond to inequality in equity under different model assumptions. All proofs are relegated to the Supplementary Appendix.

Proposition 1. Optimal Effort Response to Inequality in Equity Under Domain-

Contingent Inequality Aversion. *Let $y_2 = y_0$, then $\frac{\lim_{y_1 \uparrow y_0} \frac{\partial e_1^*}{\partial y_1}}{\lim_{y_1 \downarrow y_0} \frac{\partial e_1^*}{\partial y_1}} > 1$. Relative to equality in equity ($y_1 = y_2 = y_0$), effort responds more to equity cuts ($y_1 < y_0$) than to equity raises ($y_1 > y_0$).*

Inequality in equity has a *negative asymmetric effect* on effort. A change in y_1 affects the choice of e_1^* , and the change in the choice of e_1^* in turn may affect inequality aversion in the salary domain, causing e_1^* to readjust. By the assumption that the employee is more inequality averse in the equity domain, we conclude the effect of equity must outweigh the effect of salary. Moreover, the assumption that the worker is self interested suggests that disadvantageous equity positions (equity cuts) outweigh the effect of advantageous equity positions (equity raises), thus yielding Proposition 1. As we note in the proof of this proposition, the negative asymmetric effect is stronger (i.e., $\frac{\lim_{y_1 \uparrow y_0} \frac{\partial e_1^*}{\partial y_1}}{\lim_{y_1 \downarrow y_0} \frac{\partial e_1^*}{\partial y_1}}$ is larger) when α_y or β_y is larger.

The negative asymmetric effect of inequality in equity, stated in Proposition 1, is a unique result of our domain-contingent inequality aversion model. In the next proposition, we compare this result with implications from a model with no inequality aversion (i.e., no inequality aversion terms at all in the utility function) and a model with non-domain-contingent inequality aversion (i.e., no separation of salary and equity payoff in the inequality aversion terms).

Proposition 2. Optimal Effort Response to Inequality in Equity Absent Domain-

Contingent Inequality Aversion. *Let $y_2 = y_0$. Let \tilde{e}_1 be worker 1's optimal effort choice absent inequality aversion. Let \hat{e}_1 be worker 1's optimal effort choice under non-domain-contingent inequality aversion. Then $\frac{\lim_{y_1 \uparrow y_0} \frac{\partial \tilde{e}_1}{\partial y_1}}{\lim_{y_1 \downarrow y_0} \frac{\partial \tilde{e}_1}{\partial y_1}} = 1$ and $\frac{\lim_{y_1 \uparrow y_0} \frac{\partial \hat{e}_1}{\partial y_1}}{\lim_{y_1 \downarrow y_0} \frac{\partial \hat{e}_1}{\partial y_1}} = 1$. Relative to equality in equity ($y_1 = y_2 = y_0$), effort responds symmetrically to equity cuts ($y_1 < y_0$) and equity raises ($y_1 > y_0$).*

In contrast to the prediction of the domain-contingent inequality aversion model, Proposition 2 says that models absent domain-contingent inequality aversion predict a symmetric effect of inequality in equity on effort. Propositions 1 and 2 together suggest that the negative asymmetric effect of inequality in equity is uniquely derived from the domain-contingent inequality aversion assumption. Models without this assumption do not exhibit this effect. Therefore, we conclude that this negative asymmetric effect is a unique manifestation of domain-contingent inequality aversion.

We also derive additional results regarding how the employee responds to inequality in salary (see Proposition B.4) and how the worker’s response to inequality in salary relates to his response to inequality in equity (see Proposition B.5). These results are left to the Appendix. Furthermore, we hypothesize that the mechanism for domain-contingent inequality aversion is a perceived scarcity of equity. In other words, workers dislike inequality in equity more than inequality in salary because equity is viewed as scarce. When equity is not perceived as scarce, workers no longer experience more inequality aversion in the equity domain. Therefore, we hypothesize that domain-contingent inequality aversion appears only when equity is perceived as a scarce reward. According to Propositions 1 and 2, domain-contingent inequality aversion can be tested through the existence of a negative asymmetric effect of inequality in equity, so we hypothesize that such an effect only appears when equity is viewed as scarce.

Hypothesis 1. Domain-Contingent Inequality Aversion Under Scarce Equity. *The negative asymmetric effect of inequality in equity is only present when equity is shown as a scarce reward.*

2.3 Implications for the Firm

The propositions and hypothesis in Section 2.2 provide testable predictions for our laboratory experiment and also have implications for compensation decisions. Proposition 1 is particularly pertinent for a firm having a fixed employee equity pool, a situation faced by most firms issuing equity compensation. Firms that allocate a fixed total equity to employees devise a scheme to maximize the total effort of their workers. According to Proposition 1, the negative asymmetric effect of inequality in equity on effort suggests that equitable distribution of equity is the optimal

compensation strategy. The optimal strategy of salary compensation is less clear since firms may not set aside a fixed amount of cash for their employees. Yet, salary dispersion may be justified when inequality in salary has a positive asymmetric effect on effort under conditions specified in Proposition B.4. In the presence of a negative asymmetric effect of inequality in equity and a positive asymmetric effect of inequality in salary, the *equality-in-equity* strategy (same equity but different salary) is the optimal strategy for firms.¹² According to Hypothesis 1, such negative asymmetric effect should be present only when equity is presented in its scarcity form which suggests our next hypothesis.

Hypothesis 2. Total Group Effort. *Equality in equity induces the highest total group effort only when equity is shown as a scarce reward.*

Moreover, while our model considers a two-worker case, the implications for equity compensation can be easily extended to any firm with a fixed employee equity pool. The case of companies consisting of two worker types of equal numbers is clearly a direct extension of the two-worker case. In fact, even when there are unequal numbers of multiple worker types, any deviation from general equality will lead to a reduction in total effort in the presence of a negative asymmetric effect of inequality in equity.¹³

3 Experimental Design

We test the predictions of our model and the hypotheses using an experimental design borrowed from Charness and Kuhn (2007) and Kessler (2010), which enables us to impose a quadratic effort cost function and a linear production function to match the model specifications.

¹²The current version of this paper focuses on predictions for workers' effort choices since our lab experiment only examines responses to predetermined compensation packages. In future work, we plan to derive equilibrium results by solving the firm's problem rigorously as in Benjamin (2015).

¹³Suppose there are T types of workers. a_t is the number of workers of type t , $t = 1, 2, \dots, T$. Suppose the equity pool for workers is fixed. Under equality in equity, each worker receives equity share of the total pool $y = \frac{100}{\sum_{t=1}^T a_t}$. Let e be the optimal effort provided by each worker when everyone receives y . Under inequality in equity, suppose there are S types of workers getting less than y , then there are $T - S$ types of workers getting more than or equal to y with at least one type of workers getting more than y . Without loss of generality, let $t = 1, \dots, S$ be the types of workers getting less than y . Let y_t be the equity share of the total pool received by a type t worker and let e_t be the optimal effort provided by this type of worker. Since the equity pool is fixed, we have $\sum_{t=1}^S a_t y_t + \sum_{t=S+1}^T a_t y_t = 100 = y \sum_{t=1}^T a_t$, thus yielding $\sum_{t=1}^S a_t (y_t - y) = \sum_{t=S+1}^T a_t (y - y_t)$. In the presence of negative asymmetric effect of equality in equity, we have $\frac{\text{total increase in effort}}{\text{total decrease in effort}} = \frac{\sum_{t=1}^S a_t (e_t - e)}{\sum_{t=S+1}^T a_t (e - e_t)} < \frac{\sum_{t=1}^S a_t (y_t - y)}{\sum_{t=S+1}^T a_t (y - y_t)} = 1$, so there is a reduction in total effort.

3.1 Participants

We recruited 960 workers from Amazon Mechanical Turk (MTurk) to participate in a 15-minute study via Qualtrics during October and November 2016. MTurk workers have become a useful sample in the study of worker effort and multi-person games (Chandler and Kapelner, 2013; Dreber et al., 2013; Rand et al., 2015; Jordan et al., 2016). In particular, many studies have shown there are no significant differences between the experimental results from MTurk and those derived from physical lab settings for various types of economic games (Horton et al., 2011; Suri and Watts, 2011; Amir et al., 2012).

To insure participants pay attention to experimental materials, we conducted comprehension checks at the beginning of the experiment after the participants read the instructions. Each participant needed to correctly answer comprehension questions related to the instructions in order to proceed with the study. These questions were designed to make sure that participants understood the rules of the experiment and the factors affecting their earnings. When questions were answered incorrectly, participants were offered a new set of comprehension questions. Participants who failed three attempts were excluded from the study and were only paid their guaranteed payment. The comprehension checks screened out 186 participants, resulting in a sample size of 774 workers.

3.2 Procedures

Participants were told this study investigated individual decision making and behavior. They were informed that they could earn bonus money in addition to their guaranteed payment (\$0.25) based on their decisions in the study. The experiment had a within-subject design with each participant experiencing 7 scenarios (in a random order) of group production with different compensation schemes. In each scenario, a participant was paired with a random partner, and each received a flat payment to mimic salary and a share of group output to mimic equity. Payoffs were denoted in experiment points with each point worth \$0.001. Compensations for both people were public. Then, both participants had the opportunity to increase the probability of group success at a personal cost. Group output was $V = 500$ if the project succeeded but was zero if the project failed. In the end, one of the 7 scenarios was randomly selected to determine the final earnings of the participants. Compensation depended on decisions made by both participants in the group

and the realization of group output. Basic demographic information including gender, education, race, and work experience was collected at the end of the experiment. Instructions were conveyed in a neutral language without mentioning concepts of effort, equity, salary, firm, or worker.

3.3 Treatments

The experiment was further complemented by a between-subject design to test the specific mechanism that drives domain-contingent inequality aversion. There are two groups: *control* and *scarcity treatment*. The only difference between these two groups is the presentation of the output share. To induce a perception of a “scarce” output share, we presented output share as a percentage instead of in experiment points. For example, while workers in the control group were presented with an offer of 250 experiment points as their share of a total group output of 500 points, workers in the scarcity treatment group were presented with the equivalent 50% of output share. In principle, the description of the output share does not change the real value of the output share, but a percentage form facilitates the relative comparison of share size between participants (Dieckmann et al., 2009; Waters et al., 2006), and thus driving the salience of the finiteness of the 100% output. A fixed 100% means that there is a limited supply of output to be shared, and consequently increases the perception of scarcity.¹⁴

Compensation levels are displayed in Table 1. There were three possible levels of flat payment (high, medium, low) and three possible levels of output share (high, medium, low). The control group comprised 387 workers, for which output share was presented in experiment points. 387 workers were in the scarcity treatment group, for which output share was presented in percentage form.

—————Insert Table 1—————

Table 2 summarizes the seven individual-level scenarios experienced by each participant (in a random order). We can collapse the individual-level scenarios into group-level conditions based on output share and flat payment equality/inequality. There are four group-level conditions in total: general equality, equality in share, equality in flat payment, and general inequality. We call a

¹⁴Limiting supply is a common intervention to induce perception of scarcity in experiments (Effron and Miller, 2011; Mittone and Savadori, 2009).

higher payoff in either flat payment or output share as an *advantageous* position and a lower payoff is designated a *disadvantageous* position. Each scenario is named first by the group-level condition, and then by the advantageous or disadvantageous position of the participant. Note that we set the value of inequality in share for a successful project, e.g., $(60\% - 40\%) \times 500 = 100$, equal to the inequality in flat payment, i.e., $300 - 200 = 100$.

Insert [Table 2](#)

In each scenario, participants made a private decision to increase the probability of group project success at a personal cost. The cost schedule shown in [Table 3](#) was identical for all participants across all scenarios. We refer to the number of points sacrificed to increase project success probability as one’s contribution. There are 5 possible contribution choices that increase quadratically for each increment in success probability. The square root of this privately stated level of contribution is interpreted as our measure of unobservable effort. Each unit of effort would increase the probability of success linearly by $k = 4\%$. This type of stated effort measure is common in the experimental economics literature, especially studies on worker compensation and productivity in group production ([Nalbantian and Schotter, 1997](#); [Charness and Kuhn, 2007](#); [Clark et al., 2010](#); [Harbring and Irlenbusch, 2011](#)). The advantage of our effort measure is that we could exactly impose a quadratic effort cost function and a linear production function in the experiment and directly test our predictions in [Section 2](#).

Insert [Table 3](#)

4 Results

We first describe simple summary statistics of individual effort. We then report a regression analysis that tests our model predictions regarding domain-contingent inequality aversion and evaluates our hypothesis that perceived equity scarcity is the mechanism driving the domain-contingency. We conclude the section by providing suggestive evidence for the effect of domain-contingent inequality aversion on total group effort.

4.1 Summary Statistics of Individual Effort

Table 4 reports summary statistics for all individual-level scenarios. In both control and scarcity treatment groups, individual effort is higher in high payoff (“advantageous”) scenarios and lower in low payoff (“disadvantageous”) scenarios, relative to the general equality scenario. At the individual scenario level, the differences between the control group and the scarcity treatment group are not statistically significant, except for the general inequality (disadvantageous) scenario in which individuals in the scarcity treatment group provide less effort than those in the control group on average.

—————Insert Table 4—————

Figure 1 shows the distribution of individual effort choices under each scenario, pooling the control and the scarcity treatment groups. We group the 7 individual scenarios into 4 general group-level conditions: general equality, equality in share, equality in flat payment, and general inequality. The distributions tend to shift to the right for workers in the advantageous scenarios. Specifically, workers with both higher flat payment and higher output share than their partners (in the general inequality condition) exhibit the largest rightward shift. The rightward shift to higher effort choices also is slightly more prominent in the equality-in-share condition than in the equality-in-flat-payment condition. On the other hand, the distributions tend to shift to the left for workers in the disadvantageous scenarios. In particular, workers with both low flat payment and low output share than their partners (in the general inequality condition) exhibit the largest leftward shift. Comparing the equality-in-share condition and the equality-in-flat-payment condition, we see that fewer workers choose the lowest effort and more workers choose the highest effort when there is no inequality in share. Figure 2 shows the average individual effort choice by the grouped scenarios. In the equality-in-flat-payment condition (but inequality in share), workers in the disadvantageous position on average provide less effort than those in the disadvantageous position of the equality-in-share condition. Workers in the advantageous position on average provide less effort than those in the advantageous position of the equality-in-share condition, though not significantly so.

—————Insert Figure 1—————

—————Insert Figure 2—————

These findings provide some evidence that inequality in different domains can affect effort provision differently. Relative to the general equality condition, redistributing flat payment within the group while holding share equal appears to have a symmetric effect on effort. That is, higher flat payment increases effort by approximately the same amount that lower flat payment decreases effort. However, relative to the general equality condition, redistributing output share within the group while holding flat payment equal appears to have a negative asymmetric effect on effort. Lower share decreases effort more than the increase in effort from higher share.

We further examine how effort responds to different compensation schemes by collapsing the 7 individual scenarios based on the level of output share and flat payment respectively. Table 5 Panel A reports the summary statistics for all output share levels, and Panel B displays statistics for all flat payment levels. Panel A shows that effort on average responds to high and low output share almost symmetrically relative to medium level in the control group but responds to low output share more negatively in the treatment group. From Panel B, we see that effort responds more negatively to low flat payment in the treatment group compared to the control group and, at the same time, responds more positively to high flat payment, though not significantly so for the latter. The result in Panel A, illustrated in Figure 3, reveals that the treatment group exhibits a more prominent negative asymmetry on effort than the control group, i.e., the difference between the low share average and the baseline is larger than the difference between the high share average and the baseline. By Propositions 1 and 2, this negative asymmetric effect of inequality in equity provides evidence for domain-contingent inequality aversion. This finding is consistent with Hypothesis 1 which says that such effect should only appear in the treatment group for which equity is perceived with scarcity. In the next section, we formally evaluate the predictions of our domain-contingent inequality aversion model and the proposed mechanism of equity scarcity based on our experimental results.

Insert Table 5

Insert Figure 3

4.2 Domain-Contingent Inequality Aversion under Equity Scarcity

First, we perform a full-sample regression analysis to consider whether workers experience domain-contingent inequality aversion regarding equity and salary predicted by Propositions 1 and 2. We then conduct subsample analysis for the control group and the scarcity treatment group to test Hypothesis 1 that domain-contingent inequality aversion is driven by the perceived scarcity of equity.

Table 6 reports regression results examining how different levels of compensation affect individual effort choice. According to Propositions 1 and 2, the domain-contingent inequality aversion model predicts a negative asymmetric effect of inequality in equity, or in other words, $\gamma_1 < |\gamma_3|$. In contrast, models with non-domain-contingent inequality aversion and no inequality aversion predict a symmetric effect, i.e., $\gamma_1 = |\gamma_3|$. Consistent with the model prediction under domain-contingent inequality aversion, we find a negative asymmetric effect of inequality in equity. The estimated γ_1 is smaller than the absolute value of the estimated γ_3 (Columns (1)-(3)). In other words, workers respond more to low share than to high share. Such negative asymmetric effect is statistically significant at the 10% level for the fixed effects specification in Column (3) (p -value of the F-test is 0.0649), and presents evidence for the existence of domain-contingent inequality aversion as predicted by Proposition 1.

Insert Table 6

Experiment Finding 1. Consistent with the prediction of the domain-contingent inequality aversion model, inequality in equity has a negative asymmetric effect on effort, i.e., effort responds more to low share than to high share.

Furthermore, recall that Hypothesis 1 says that the domain-contingency is driven by perceived scarcity of equity, and predicts that $\gamma_1 < |\gamma_3|$ for the treatment group while $\gamma_1 = |\gamma_3|$ for the control group. In Table 6, we see that the negative asymmetric effect of inequality in equity becomes more prominent in the treatment subsample (Column (4)) with a p -value of 0.0593 for the F-test, but turns out to be statistically insignificant in the control subsample (Column (5)) with a p -value of 0.4559 for the F-test. Hence, the test confirms Hypothesis 1 since the domain-contingency inequality aversion only appears in the treatment group for which equity is a scarce reward.

Experiment Finding 2. We find that domain-contingent inequality aversion (i.e., more severe inequality aversion in the output share domain than in the flat payment domain) only appears when equity is presented in the scarcity format but does not appear when equity is presented in the same format as the flat payment.

Table 6 also provides results having implications regarding the parameter space for the degree of inequality aversion in the two separate domains. First, notice that the effect of inequality in flat payment appears to be positive asymmetric since high flat payment increases effort more than the drop in low flat payment ($\gamma_2 > |\gamma_4|$), though this asymmetric effect is marginally statistically significant at the 10% level.¹⁵ Second, relative to general equality, low share induces a larger decrease in effort than low flat payment ($|\gamma_3| > |\gamma_4|$) even when the share reduction is at most equal to that of the flat payment reduction.¹⁶ The difference is statistically significant at the 1% level.¹⁷ Third, we see that effort responds less to an increase in share than to an increase in flat payment ($\gamma_1 < \gamma_2$), though not significantly so.¹⁸ According to Propositions B.4 and B.5, given the model assumption of domain-contingent inequality aversion, these results imply that $\alpha_x - \beta_x \leq 2\alpha_x\beta_x$.

4.3 Total Group Effort

Examining the group level outcomes, we test Hypothesis 2 that predicts that equality in equity induces the highest total group effort only when equity is shown as a scarce reward. In other words, offering the same equity but different salaries is the optimal firm compensation strategy only in presence of domain-contingent inequality aversion.

Figure 4 plots the distributions of total group effort under each group-level condition. Compared to the general equality condition, the figure demonstrates that more groups provide the highest possible effort in the equality-in-share condition, and fewer groups do so in the equality-in-flat-payment condition. Moreover, compared to the equality-in-share condition, more groups in the equality-in-flat-payment condition are in the lower effort range.

————— Insert **Figure 4** —————

¹⁵ p -value from F-test of the null hypothesis that $\gamma_2 + \gamma_4 = 0$ is 0.1082.

¹⁶The value of share reduction is at most $(60\% - 50\%) \times 500 = 50$. The value of flat payment reduction is $300 - 250 = 50$.

¹⁷ p -value from F-test of the null hypothesis that $\gamma_3 = \gamma_4$ is 0.0036.

¹⁸ p -value from F-test of the null hypothesis that $\gamma_1 = \gamma_2$ is 0.4222.

Figure 5 also illustrates the average total group effort across conditions. While average total group effort is the highest under the equality-in-share condition for the treatment group, group effort is lower than the average total group effort under other conditions (general equality and general inequality) for the control group. This finding, though not statistically significant, is consistent with Hypothesis 2 that equality-in-share is the optimal compensation strategy (in the sense of inducing the highest total group effort) only when share is shown as a scarce reward in percentage form. A regression analysis further supports this conclusion. Table 7 reports regression results examining how total group effort is affected by different group-level conditions. We find that total group effort is higher under the equality-in-share condition relative to the equality-in-flat-payment condition (Column (1)), and more so when we restrict to the scarcity treatment subsample. While we do not have enough statistical significance for our estimates, the signs suggest that the equality-in-share condition induces higher total effort than all the other conditions only in the scarcity treatment sample (i.e., when share is shown in the percentage form).

—————Insert **Figure 5**—————

—————Insert **Table 7**—————

These suggestive findings are consistent with the implications from our experimental results in the previous section. Domain-contingent inequality aversion implies that inequality in output share has a negative asymmetric effect on effort while inequality in flat payment can have a positive asymmetric effect on effort. As a result, the equality-in-share condition (but inequality in flat payment) would induce the highest total group effort in the presence of domain-contingent inequality aversion, i.e., in the treatment group, but not in the control group when domain-contingent inequality aversion is absent.

5 Conclusion

Motivated by an empirical observation of equity compression but salary dispersion in employment offers posted online, we propose a behavioral model of domain-contingent inequality aversion. We argue that workers dislike inequality in the equity domain more than salary inequality because of the perceived scarcity of equity. In contrast to other models with non-domain-contingent inequality

aversion or no inequality aversion, our model features a negative asymmetric effect of inequality in equity. This negative asymmetric effect, coupled with a possible positive asymmetric effect of inequality in salary, suggests that the *equality-in-equity* compensation strategy could benefit firms. Our experimental findings produce corroborating evidence for the existence of domain-contingent inequality aversion, and further demonstrate that such domain-contingency is largely driven by a perception of equity scarcity.

Our experiment enables us to focus on the proposed mechanism of perceived scarcity of equity. The design screens out many alternative mechanisms, such as a failure to recognize the importance of equity (since most employees do not understand the value of the options they hold),¹⁹ differential bargaining power over equity versus salary, distinct information structures (salary information is likely confidential while equity information is likely public knowledge), and overoptimism about the equity value (Bergman and Jenter, 2007; Oyer and Schaefer, 2005) since both equity and salary are essential, non-negotiable, public, and bounded in our design. Our results, however, do not rule out two other potential mechanisms for why equity and salary occupy separate domains. Perhaps equity differs from salary because of its non-pecuniary benefits, such as a sense of ownership and legitimacy of status (Graham et al., 2002; Hamilton, 2000). Also, equity likely might be viewed as a current asset while cash might just be viewed as current income, in which case cash and equity are in different mental accounts that interact differently with individual inequality aversion (Shefrin and Thaler, 1988). These alternatives would complement the view of domain-contingent inequality aversion.

The model explored in the paper can be extended to incorporate more realistic features. For instance, we can consider status-seeking preferences (i.e., $\beta_x, \beta_y < 0$), risk-averse workers, or workers with productivity differences to study how the conclusions from our model can be generalized. To address external validity concerns of the experimental findings and to test the boundary conditions of our theory, we intend to conduct a series of enhanced lab studies in the future. First, our current design is neutrally framed to limit contextual cues and avoid established behavior patterns (Charness and Kuhn, 2011). The design can be replicated in a context wherein worker-firm relationship is stated explicitly. For example, an artefactual field experiment involving a subject pool

¹⁹Casserly, M. (2013, March 8) Understanding Employee Equity: Every Startup’s Secret Weapon. *Forbes*. Retrieved from <http://www.forbes.com>.

of startup workers instead of undergraduate students would substantially mitigate external validity concerns. Second, we would like to investigate whether our results would be robust to larger group sizes or different group compositions ([Isaac and Walker, 1988](#)). Other extensions could develop the production function with alternative production processes: a linear process with heterogeneous worker impacts on output, a minimum game type of production function ([Van Huyck et al., 1990](#)), a multiplicative production function that encompasses complementarity between workers' effort, a production function that pays off a large amount for output share with low probability even if maximum effort is supplied, etc. We also may incorporate a real effort task that requires relatively high skills. For instance, we can target a subject pool of students majoring in engineering and ask them to perform a coding task for which we will measure the number of lines they code and the quality of the code.

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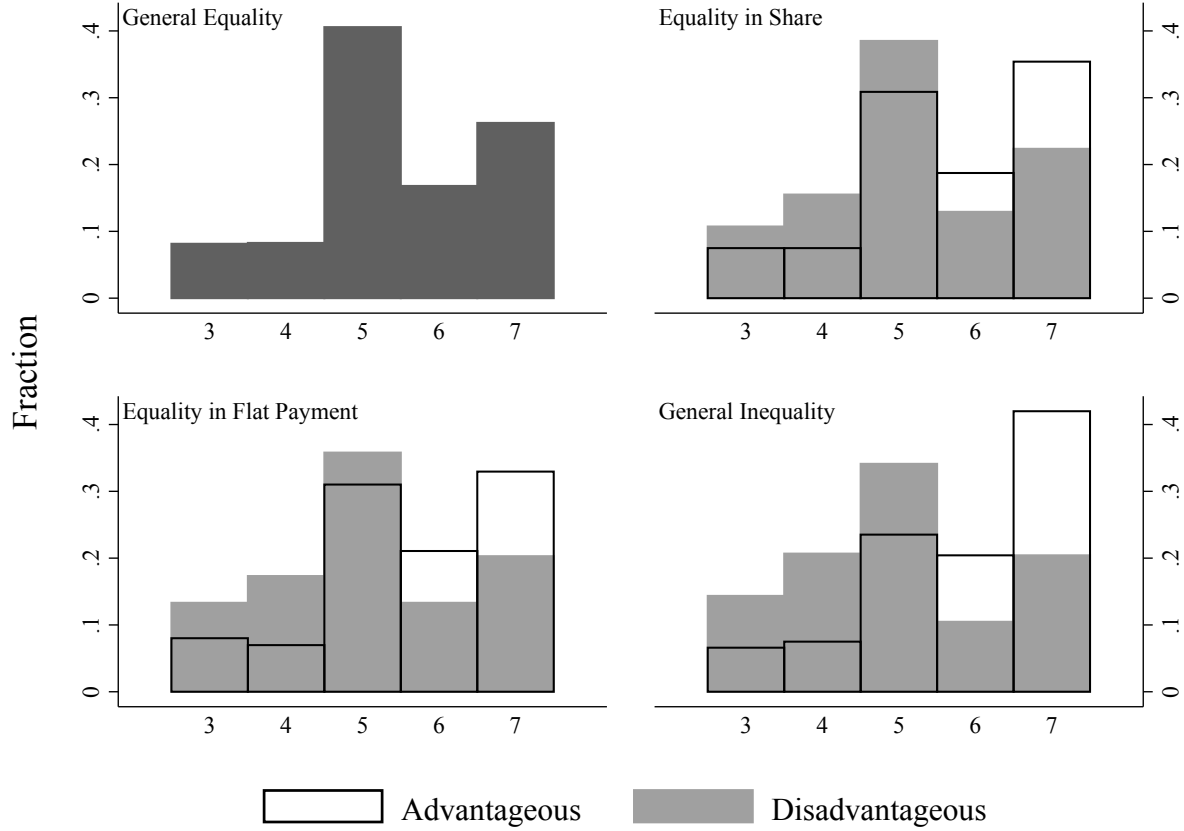


Figure 1: **Distributions of Individual Effort Choice by Scenario.** This figure shows the distribution of individual effort choices under each scenario, pooling the control and the scarcity treatment groups. The 7 individual-level scenarios are organized into 4 general group-level conditions in 4 subfigures: general equality (top left), equality in share (top right), equality in flat payment (bottom left), and general inequality (bottom right). The x-axis represents individual effort choice. Note that effort choice is converted from individual contribution to the group and ranges from 3 to 7. The y-axis and the histograms represent the fractions of each effort choice within the condition. In the equality-in-share condition, equality-in-flat-payment condition, and general inequality condition, there are two types of scenarios: advantageous (white bars with black outlines) and disadvantageous (light grey bars). In the equality-in-share condition, advantageous refers to the scenario with high flat payment; disadvantageous denotes the scenario with low flat payment. In the equality-in-flat-payment condition, advantageous scenario signifies the scenario with high output share while disadvantageous scenario refers to the scenario with low output share. In the general inequality condition, advantageous scenario refers to the scenario with both high flat payment and high output share while disadvantageous scenario signifies the scenario with both low flat payment and low output share.

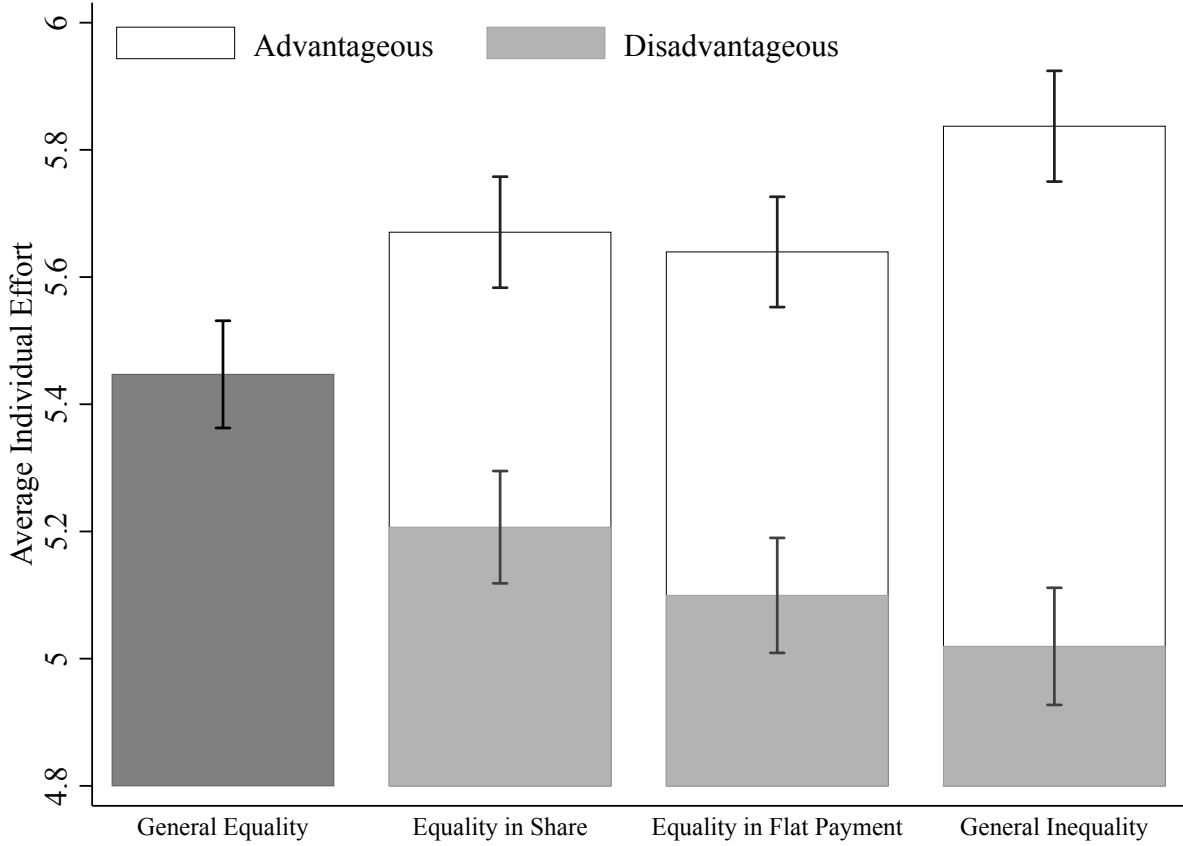


Figure 2: **Average Individual Effort Choice by Scenario.** This figure shows the average individual effort choice by scenarios, pooling the control and the scarcity treatment groups. The 7 individual-level scenarios are organized into 4 general group-level conditions in 4 bars: general equality (first bar), equality in share (second bar), equality in flat payment (third bar), and general inequality (fourth bar). The x-axis represents the condition. The y-axis represents the average individual effort. Error bars are displayed in black, representing 95% confidence intervals. In the equality-in-share condition, equality-in-flat-payment condition, and general inequality condition, there are two overlaid bars that represent two types of scenarios: advantageous (white bars with black outlines) and disadvantageous (light grey bars). In the equality-in-share condition, advantageous scenario refers to the scenario with high flat payment while disadvantageous scenario denotes the scenario with low flat payment. In the equality-in-flat-payment condition, advantageous scenario refers to the scenario with high output share while disadvantageous scenario signifies the scenario with low output share. In the general inequality condition, advantageous scenario refers to the scenario with both high flat payment and high output share while disadvantageous scenario denotes the scenario with both low flat payment and low output share.

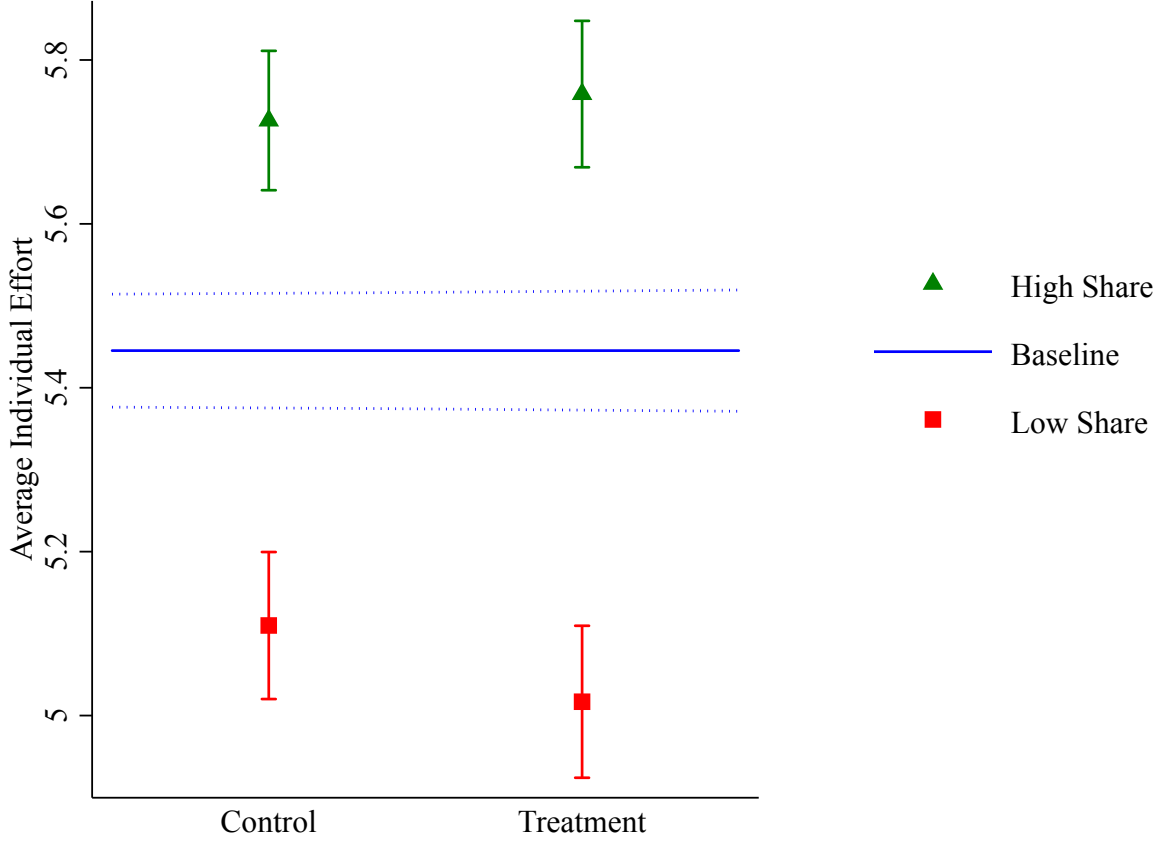


Figure 3: **Average Individual Effort Choice by Output Share Level.** This figure shows the averages of individual effort at different compensation levels for the control and scarcity treatment groups respectively, in support of the claim that the treatment group exhibits a more prominent negative asymmetry on effort than the control group. The x-axis represents the control and treatment group. The y-axis represents the average individual effort. All scenarios are organized by the level of output share (high, medium, low). The green triangles represent the averages of individual effort for scenarios with high output share level. The blue solid line (labeled baseline) represents the averages for scenarios with medium output share level. The red squares represent the averages for scenarios with low output share level. All averages in the treatment group are normalized to the control group baseline. Error bars are displayed for the high share and low share levels, representing 95% confidence intervals. For the medium share levels, the 95% confidence intervals are plotted in blue dashed lines.

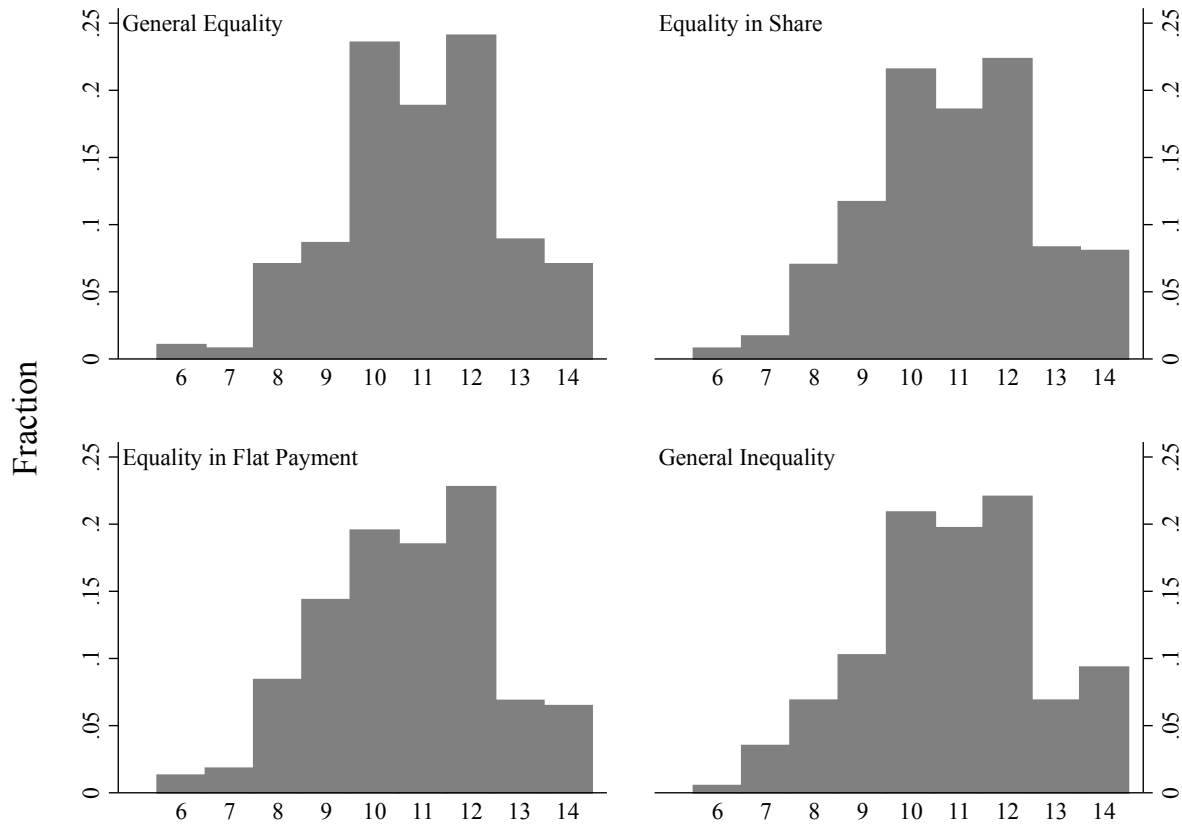


Figure 4: **Distributions of Total Group Effort by Condition.** This figure shows the distributions of total group effort provision under each group level condition, pooling the control and scarcity treatment groups. There are 4 general group-level conditions, shown in 4 subfigures: general equality (top left), equality in share (top right), equality in flat payment (bottom left), and general inequality (bottom right). The x-axis represents total group effort, which is the sum of the individual effort choices of the two workers in the same group. Note that total group effort ranges from 6 to 14. The y-axis and the histograms represent the fractions of each group effort choice within the condition.

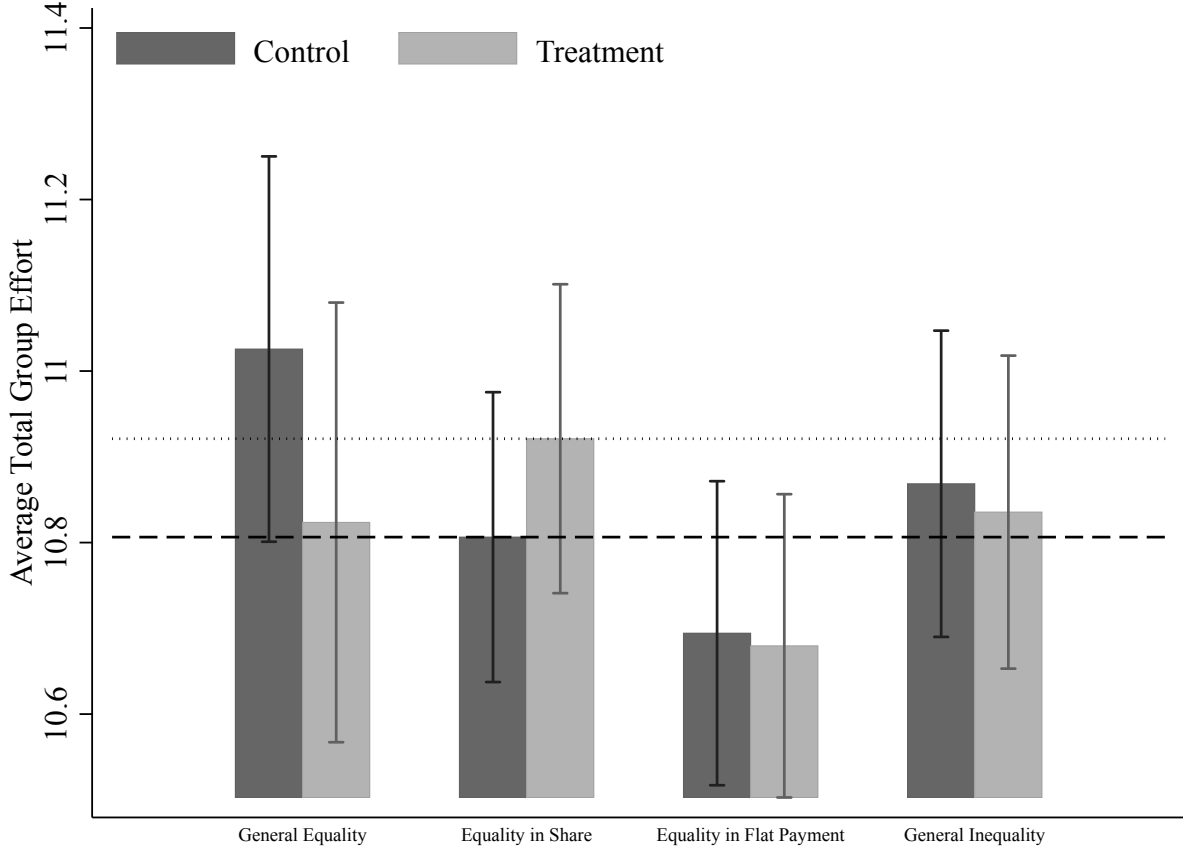


Figure 5: **Average Total Group Effort by Condition.** This figure shows the average total group effort across conditions for the control and scarcity treatment groups respectively, in support of Hypothesis 2. There are 4 general group-level conditions: general equality, equality in share, equality in flat payment, and general inequality. The x-axis represents the group-level conditions. The y-axis and the bars represent the average total group effort. The control group averages are in dark grey and the scarcity treatment group averages are in light grey. Error bars are displayed, representing 95% confidence intervals. The black dashed horizontal line is added to compare the equality-in-share condition with other conditions for the control group. The grey dotted horizontal line is added to compare the equality-in-share condition with other conditions for the scarcity treatment group.

Table 1: **Levels of Compensation.** This table displays the possible levels of flat payment and output share. There are three possible levels for either flat payment or output share: high, medium, and low. Flat payment is shown in experiment points. Output share is presented in different formats depending on the group. In the control group, output share if the project succeeds is shown in experiment points. In the scarcity treatment group, output share is shown in percentage. Note that the total group output is 500 points if the project succeeds, so the value of output share is the same in both control and scarcity treatment groups.

Level	Flat Payment	Output Share	
		Control (Points)	Scarcity Treatment (%)
High	300	300	60%
Medium	250	250	50%
Low	200	200	40%

Table 2: **All Individual-Level Scenarios.** This table shows the 7 individual-level scenarios. First column provides the names of scenarios. Each scenario is named first by the group-level condition (general equality, equality in share, equality in flat payment, general inequality) and then named by the advantageous or disadvantageous position. Second and third columns show the amount of flat payment (in experiment points) received by the participant and his partner respectively given the scenario. Fourth and fifth columns show the amount of output share received by the participant and his partner respectively given the scenario. Note that output share is shown in percentage form for the scarcity treatment group and is shown in experiment points for the control group.

Scenario	Flat Payment		Output Share	
	Participant	His Partner	Participant	His Partner
(a) General Equality	250	250	50% / 250	50% / 250
(b) Equality in Share (Advantageous)	300	200	50% / 250	50% / 250
(c) Equality in Share (Disadvantageous)	200	300	50% / 250	50% / 250
(d) Equality in Flat Payment (Advantageous)	250	250	60% / 300	40% / 200
(e) Equality in Flat Payment (Disadvantageous)	250	250	40% / 200	60% / 300
(f) General Inequality (Advantageous)	300	200	60% / 300	40% / 200
(g) General Inequality (Disadvantageous)	200	300	40% / 200	60% / 300

Table 3: **Cost Schedule for Increasing Probability of Group Project Success.** This table shows the cost schedule for increasing probability of group project success. Probability of success can be increased linearly at a 4% interval. We refer to the number of points sacrificed to increase project success probability as one's contribution. There are 5 possible levels of contribution, increasing quadratically. The square root of this privately stated level of contribution is interpreted as our measure of unobservable effort.

Increased Probability of Success	12%	16%	20%	24%	28%
Cost of Points (Contribution, Seen)	9	16	25	36	49
Effort Choice ($\sqrt{\text{Contribution}}$, Unseen)	3	4	5	6	7

Table 4: **Summary Statistics: Means of Individual Effort Choice by Scenario.** This table reports the summary statistics for individual effort choice by individual-level scenario. The first column lists all the scenarios. The second and third columns report the means of individual effort and standard errors (in parentheses) for the control group and the scarcity treatment group respectively. The fourth column shows the full sample averages and standard errors (in parentheses). The last column reports the p -values from two-tailed t -tests between the control group and the treatment group (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Scenario	Group		Total	p -Value
	Control	Treatment		(Control vs. Treatment)
(a) General Equality	5.47 (0.059)	5.42 (0.062)	5.45 (0.043)	0.55
(b) Equality in Share (Advantageous)	5.64 (0.060)	5.70 (0.066)	5.67 (0.044)	0.54
(c) Equality in Share (Disadvantageous)	5.22 (0.062)	5.19 (0.065)	5.21 (0.045)	0.77
(d) Equality in Flat Payment (Advantageous)	5.65 (0.061)	5.63 (0.064)	5.64 (0.044)	0.84
(e) Equality in Flat Payment (Disadvantageous)	5.10 (0.063)	5.10 (0.067)	5.10 (0.046)	0.93
(f) General Inequality (Advantageous)	5.80 (0.061)	5.87 (0.064)	5.84 (0.044)	0.45
(g) General Inequality (Disadvantageous)	5.12 (0.066)	4.92 (0.066)	5.02 (0.047)	0.04**
Observations	387	387	774	

Table 5: **Summary Statistics: Means of Individual Effort Choice by Compensation Level.** This table reports the summary statistics for individual effort choice by compensation level. In Panel A, each scenario is categorized based on the level of output share (high, medium, low). In Panel B, each scenario is categorized based on the level of flat payment (high, medium, low). Note that for both Panels A and B, there are 774 observations for high and low levels per group (control or treatment), and 1,161 observations for medium levels per group (control or treatment). For both panels, the first column lists the compensation level, the second and third columns report the means of individual effort and standard errors (in parentheses) for the control group and the scarcity treatment group respectively, the fourth column shows the full sample averages and standard errors (in parentheses), and the last column reports the p -values from two-tailed t -tests between the control group and the treatment group (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

	Group			<i>p</i> -Value
Level	Control	Treatment	Total	(Control vs. Treatment)
Panel A: Levels of Output Share				
High	5.73 (0.043)	5.75 (0.046)	5.74 (0.031)	0.70
Medium	5.45 (0.035)	5.44 (0.038)	5.44 (0.026)	0.88
Low	5.11 (0.046)	5.01 (0.047)	5.06 (0.033)	0.13
Panel B: Levels of Flat Payment				
High	5.72 (0.043)	5.78 (0.046)	5.75 (0.031)	0.33
Medium	5.41 (0.036)	5.38 (0.038)	5.40 (0.026)	0.62
Low	5.17 (0.045)	5.06 (0.047)	5.11 (0.033)	0.092*

Table 6: **Regression Results for Individual Effort.** This table shows the regression results for individual effort, in support of Proposition 1 and Hypothesis 1. The dependent variable is individual effort. The independent variables include the indicators for each output share level (high, medium, low) and for each flat payment level (high, medium, low). Medium share and medium flat payment indicators are dropped as reference categories. Columns (1)-(3) report the estimates using the full sample. Column (1) shows the estimates for the main regression specification. Column (2) shows the estimates when additional individual controls are included. The individual controls include gender, education, race, and whether the person has working experience or not. Column (3) shows the estimates when individual fixed effects are added. Column (4) shows the estimates for the scarcity treatment group. Column (5) shows the estimates for the control group. Robust standard errors are reported in parentheses, and are clustered at the individual level in the fixed effects regression (Column (3)). p -values from the F-tests on $\gamma_1 = |\gamma_3|$ are reported.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Dependent Variable: Individual Effort				
	Full Sample			Subsamples	
	OLS (1)	OLS (2)	FE (3)	Treatment (4)	Control (5)
High Share (γ_1)	0.202*** (0.043)	0.202*** (0.042)	0.202*** (0.028)	0.200*** (0.040)	0.204*** (0.040)
High Flat Payment (γ_2)	0.233*** (0.043)	0.233*** (0.042)	0.233*** (0.027)	0.267*** (0.039)	0.199*** (0.037)
Low Share (γ_3)	-0.276*** (0.044)	-0.275*** (0.044)	-0.276*** (0.027)	-0.305*** (0.037)	-0.247*** (0.040)
Low Flat Payment (γ_4)	-0.169*** (0.044)	-0.170*** (0.043)	-0.169*** (0.026)	-0.207*** (0.037)	-0.131*** (0.037)
F-test p -value ($\gamma_1 = \gamma_3 $)	0.2815	0.2872	0.0649*	0.0593*	0.4559
Constant	5.420*** (0.034)	4.231*** (0.211)	5.420*** (0.017)	5.418*** (0.024)	5.423*** (0.025)
Individual Controls	No	Yes	No	No	No
Individual Fixed Effects	No	No	Yes	Yes	Yes
Observations	5,418	5,411	5,418	2,709	2,709

Table 7: **Regression Results for Total Group Effort.** This table shows the regression results for total group effort, in support of Hypothesis 2. The dependent variable is total group effort. The independent variables include the indicators for all group-level conditions: general equality, equality in share, equality in flat payment, and general inequality. The reference condition is equality-in-share (but inequality in flat payment) and is hence dropped. Column (1) reports the estimates using the full sample. Column (2) shows the estimates for the scarcity treatment group. Column (3) shows the estimates for the control group. Robust standard errors are reported in parentheses. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$.

	Dependent Variable:		
	Total Group Effort		
	Full Sample	Treatment	Control
	(1)	(2)	(3)
General Equality (δ_1)	0.062 (0.107)	-0.098 (0.159)	0.219 (0.143)
Equality in Flat Payment (δ_2)	-0.178** (0.089)	-0.242* (0.128)	-0.112 (0.125)
General Inequality (δ_3)	-0.013 (0.090)	-0.086 (0.130)	0.062 (0.125)
Constant	10.865*** (0.063)	10.921*** (0.092)	10.806*** (0.086)
Observations	2,696	1,350	1,346

A Appendix: The Empirical Puzzle

Traditional theories in economics and finance provide a variety of motivations for why firms offer equity compensation to employees. First, equity may be used as a retention tool. [Fama \(1980\)](#) observes that a firm's incentive system must be linked to firm performance to retain employees. Equity is one type of compensation whose value is closely tied to firm performance. Moreover, equity compensation, typically in the form of stock options, is often implemented with a cliff to force employees to stay for at least one year and the options stop vesting when employees leave (vesting usually happens over a 4-year period). In some cases, the stocks are clawed back when employees leave to work for a competing firm or simply upon leaving. In this retention view, key positions should have compensation packages weighted more in equity, where key positions are those with high costs of replacement and are likely in higher ranks. Second, equity compensation may address agency issues by incentivizing productivity and minimizing shirking. Since employees will also be compensated based on how well the firm does, the profit-sharing aspect can align interests and motivate employees, and hence reduce monitoring costs for the firm ([Duncan, 2001](#); [Ehrenberg and Milkovich, 1987](#); [Freeman et al., 2008](#); [Jensen and Meckling, 1976](#)). Firms should design more equity-weighted packages for high-ranking positions where the impact of individual decision making on the organization is larger and concerns for moral hazard are more important. Third, equity compensation enables a liquidity-constrained firm to retain cash for other purposes, such as preempting new opportunities, reducing potential costs from financial distress, and serving competitive purposes ([Baskin, 1987](#); [Denis and Sibilkov, 2010](#); [John, 1993](#)). This preference for cash is suggested by the pecking order theory ([Myers and Majluf, 1984](#)), which says that firms would want to use internal funds to finance investments. Therefore, firms experiencing cash flow difficulties or borrowing constraints and firms having stronger growth opportunities are more likely to substitute equity for salary ([Bettis et al., 2005](#); [Opler et al., 1999](#)). Substitution would be exploited more often to pay key positions that should receive higher total compensation. Collectively, these theories suggest that higher ranking jobs within a firm would receive compensation packages more heavily weighted in equity.

However, using data on compensation packages from online startup job postings, we find a pattern that cannot be explained by these theories. Many firms offer the same level of equity

compensation to all new positions regardless of rank or function, and packages for higher ranking positions are weighted less in equity. We label this phenomenon as “adopting an *equality-in-equity* strategy” and propose a behavioral theory of *domain-contingent inequality aversion* in the following sections that is consistent with this empirical observation.

Our cross-sectional sample contains job postings listed by startup companies on AngelList,²⁰ an online platform that operates a popular registry of jobs, generally technology jobs, for startup firms in the web and information technology space. Startups post jobs freely on AngelList and each job description includes the role, location, qualifications, and compensation package, which typically consists of salary and equity. Job candidates view the postings and can apply to the jobs through the platform after creating a profile. According to AngelList, as of June 2016, the site has attracted 539,076 active members with over 6,000 new candidates joining weekly. 18,780 startups have joined AngelList to recruit talent and over 4,400 companies have successfully hired candidates from the platform. According to Bernstein et al. (2017), over 60% of the young firms that raised a seed round in 2013 have an AngelList profile,²¹ and thus the startups active on AngelList largely represent young, private firms that drive job creation and productivity growth in the economy (Decker et al., 2014; Haltiwanger et al., 2013).

Our job posting data are collected from AngelList in October 2015 during a relative boom period for Silicon Valley and the information technology sector, resulting in a high demand for talent. We screen the postings to include only non-co-founder and non-intern full-time positions in the U.S. with positive salary compensation; equity compensation may be zero.²² Only firms that recruit jobs at more than one job rank cross-sectionally are included. These screening criteria restrict our sample to 4,744 job postings listed by 1,034 startup companies. The majority (96%) of the firms in our sample has less than 200 employees and the average firm is 4.4 years old. The firms spread across 37 different U.S. states and 38 industries are represented in our sample, such as information technology, mobile, e-Commerce, leisure, finance, biotechnology, etc. We categorize each job listed by these firms and assign a function and a rank based on the job title and detailed job description. Our sample of postings cover four broad job functions and nine job ranks. The job functions include

²⁰angel.co.

²¹Based on a comparison to the CrunchBase database.

²²7% of the observations list zero equity compensation. Our regression results in Table A.4 remain the same if we exclude these observations.

engineer roles (software, hardware, others), business roles (sales and marketing, client and customer services, office and secretary role, operations, quality assurance, product, others), data roles, and designer roles. The ranks include analyst, junior, senior, lead, manager, director, VP, head, and chief. To address potential inconsistency in how firms name the rank of their positions, we also assign an intra-firm rank to each job by comparing its rank to the ranks of other jobs listed by the same firm.²³ Table A.1 shows the number of job postings by job function and by job rank.

—————Insert Table A.1—————

In the job postings, firms list the corresponding salary and equity compensation.²⁴ We categorize firms based on their compensation strategy according to whether the firm pays its employees with (1) different equity and salary compensation, (2) same equity but different salary compensation, (3) same salary but different equity compensation, or (4) same equity and salary compensation. Table A.2 shows that about 22% of the firms in our sample adopts an *equality-in-equity* strategy (Same Equity & Different Salary) regardless of job rank and function. Within a firm that adopts the *equality-in-equity* strategy, when a higher ranking job receives higher salary but the same equity compared to a lower ranking job, the former receives a compensation package that is more heavily weighted in salary, contrary to the recommendations of the traditional theories we discussed earlier. Our theory of domain-contingent inequality aversion, however, rationalizes the use of this *equality-in-equity* strategy, as is shown in Section 2.

—————Insert Table A.2—————

To demonstrate further the empirical inconsistency with traditional theories, we focus on the 227 firms that adopt the *equality-in-equity* strategy, and examine the relationship between the weight of equity in a compensation package and the rank of the job by exploring intra-firm variation in the equity-to-salary ratio (E/S ratio), where

$$\text{E/S ratio} = \frac{\text{Equity in } 0.01\%}{\text{Salary in } \$1000}.$$

²³For instance, if a firm only lists job postings for an analyst job, a senior job, and a VP job, then the analyst job will have intra-firm rank 1, the senior job will have intra-firm rank 2, and the VP job will have intra-firm rank 3.

²⁴Each job posting specifies a range for salary in \$1000 and a range for equity in %. We use the mean of each range as the compensation data point for a given job posting. Furthermore, we rescale equity compensation by 100 so that equity is in 0.01%.

The E/S ratio reflects job compensation in equity relative to salary in absence of knowledge of firm value. Within the same firm, a job with higher E/S ratio has a compensation package that is more heavily weighted in equity, vice versa.²⁵ Using firm fixed effects regressions, we examine the relationship between E/S ratio and job ranks or functions, controlling for firm-specific unobservables. The main specification is:

$$\text{E/S Ratio}_{ij} = \beta_0 + \text{Rank}'_{ij}\beta_1 + \text{Function}'_{ij}\beta_2 + f_i + u_{ij}$$

where E/S Ratio_{ij} is the equity-to-salary ratio for job j of firm i , Rank_{ij} is the vector of the job rank dummies for job j of firm i , Function_{ij} is the vector of the job function dummies for job j of firm i , and f_i are the firm fixed effects. β_1 and β_2 are vectors of coefficients. Table A.3 lists the alternative theories and the corresponding predictions for the signs of elements in β_1 . The liquidity constraint, retention, and performance incentive motivations imply that, within a firm, as the rank of a job increases, the job should be compensated with a greater weight in equity and hence a higher E/S ratio, implying that $\beta_1 > 0$. On the other hand, the domain-contingent inequality aversion theory says that workers are more inequality-averse in the equity domain than in the salary domain and firms take such preferences into consideration. As we show in Section 2, this theory suggests that a firm would adopt an *equality-in-equity* strategy. Therefore, while the firm may offer more salary as the job rank moves up, it would give the same equity to all employees, producing a lower

²⁵We are interested in how equity compensation is used as a percentage of total compensation, i.e., the weight of equity in total compensation that consists of both equity and salary. However, there is considerable uncertainty regarding the monetary value of equity for a given firm. Fortunately, we do not need to observe this value to identify the relevant variation in compensation structure. Specifically, we claim that variation in equity-to-salary (E/S) ratio would reflect variation in equity as a percentage of total compensation, at least direction-wise. The claim is supported by the following: Let a compensation package be characterized by (x, y) where $x > 0$ is the salary in dollars and $y > 0$ is the equity in percentage. Note that the form of the equity compensation is in stock options, so the value would be dependent on expected future growth of the firm. Let \tilde{V} be the unknown value of equity compensation per percentage. Note that the perceived \tilde{V} should be positive, otherwise there would be no reason for providing equity. Consider another compensation package characterized by (x', y') where $x' > 0$ and $y' > 0$. Then we have

$$\begin{aligned} \frac{y}{x} > \frac{y'}{x'} &\Leftrightarrow yx' > y'x \\ &\Leftrightarrow yx' + yy'\tilde{V} > y'x + yy'\tilde{V} \\ &\Leftrightarrow y(x' + y'\tilde{V}) > y'(x + y\tilde{V}) \\ &\Leftrightarrow \frac{y}{x + y\tilde{V}} > \frac{y'}{x' + y'\tilde{V}} \end{aligned}$$

Therefore, we may use equity-to-salary ratio to characterize the structure given a compensation package for a job since a high ratio suggests that equity has a larger weight in the package.

E/S ratio as rank increases and suggesting that $\beta_1 < 0$.

Insert Table A.3

Table A.4 provides results for the firm fixed effects regression using the firms adopting the *equality-in-equity* strategy are presented in Column (1) is the main specification. The reference group is the group of engineer roles in analyst rank. The estimated coefficients on the Senior, Lead, Manager, VP, and Chief rank dummies are negative and statistically significant, suggesting that most elements in β_1 are negative. The estimates on the rest of the rank dummies are statistically insignificant. The evidence for $\beta_1 < 0$ is stronger when we replace the job rank dummies in Column (1) by the intra-firm job rank dummies in the Column (3) specification. The intra-firm job rank dummies are defined such that the lowest rank within a firm is always labeled as Rank 1, the second lowest rank is labeled as Rank 2, and so on. Since the firm having the most ranks among listed jobs recruits across seven job ranks, Rank 7 is the highest possible intra-firm rank. We find that all estimates on the intra-firm rank dummies are negative and statistically significant at the 5% level (and mostly significant at the 1% level), supporting the hypothesis that $\beta_1 < 0$. Higher ranking jobs have lower E/S ratio than the lowest rank jobs. Results remain unchanged when additional location dummies are included in Columns (2) and (4). Across all specifications, we control for job function and find positive coefficients for the business and designer dummies at the 1% significance level, implying that business and designer roles have higher E/S ratios than engineer roles.

Insert Table A.4

Our results assume that the posted compensation package ranges reflect the actual compensation package offered after hiring. Brenčič (2012) shows that employers are less likely to post a wage offer when searching for skilled workers. Search theory typically assumes that wage offers would be contractually binding, and when posted wages are negotiable, negotiation is often assumed to happen within the posted ranges (Brenčič, 2012). However, data on the potential differences between posted wage offers and subsequent starting wages are limited.

In summary, for the firms adopting the *equality-in-equity* strategy in our sample, we find evidence for $\beta_1 < 0$, suggesting that the lowest ranking jobs have compensation packages more heavily weighted in equity as reflected by higher E/S ratios. Therefore, existing traditional theories that

predict a positive relationship between job rank and equity weight are insufficient for explaining the behavior of firms that distribute equal shares of equity. Moreover, since these firms offer workers the same equity, high-ranking jobs compensated with smaller weights in equity necessarily receive more salary. Our proposed behavioral theory suggests a new channel for consideration. In Section 2, we find a negative asymmetric effect of inequality in equity and mixed effects of inequality in salary when workers are more inequality averse in the equity domain than in the salary domain. The implication is that firms would want to adopt the *equality-in-equity* strategy by granting employees the same equity regardless of job rank while allowing for more variance in salary. Consequently, low-ranking jobs receive compensation packages more heavily weighted in equity.

Table A.1: **Job Posting Frequency by Job Function and Rank.** Job ranks are listed in ascending order. Analyst is the lowest rank. Chief is the highest rank. Source: Author’s categorization using job posting data from AngelList.

Job Function	Number of Observations	Job Rank	Number of Observations
Engineer	2,175	Analyst	2,195
Business	2,096	Junior	176
Data	199	Senior	767
Designer	274	Lead	318
Total	4,744	Manager	792
		Director	274
		VP	112
		Head	90
		Chief	20
		Total	4,744

Table A.2: **Number of Firms by Compensation Strategy.** Source: Author's categorization using job posting data from AngelList.

Compensation Strategy	Number of Firms	Percent
Different Equity & Salary	717	69.34
Same Equity & Different Salary	227	21.95
Same Salary & Different Equity	23	2.22
Same Salary & Equity	67	6.48
Total	1,034	100

Table A.3: **Predictions on β_1 by Competing Theories.** This table lists the alternative theories and the corresponding predictions for the signs of elements in β_1 . $\beta_1 > 0$ implies that a job with higher rank has a higher E/S ratio or, equivalently, is compensated with a greater weight in equity than in salary. $\beta_1 < 0$ implies the opposite.

Theory	Prediction
Liquidity Constraint Theory	$\beta_1 > 0$
Retention Theory	$\beta_1 > 0$
Performance Incentive Theory	$\beta_1 > 0$
Domain-Contingent Inequality Aversion Theory	$\beta_1 < 0$

Table A.4: **Firm Fixed Effects Regression.** Robust standard errors clustered at the firm level are reported in parentheses. Equity is reported in 0.01% and salary in \$1000. The sample is job postings by the 227 firms that adopt the *equality-in-equity* strategy. The reference job rank (absolute) is analyst. Intra-firm job ranks (relative) are recoded within firms, and the reference intra-firm job rank is the lowest within-firm job rank. The reference job function is engineer. Location dummies include Silicon Valley, other CA, New York, Boston, Chicago, and DC; the coefficients on location dummies are largely statistically insignificant and unreported in this table. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$.

	E/S Ratio			E/S Ratio	
	(1)	(2)		(3)	(4)
<u>Job Rank (Absolute)</u>			<u>Job Rank (Relative)</u>		
Junior	0.015 (0.032)	0.015 (0.032)	Rank 2	-0.033*** (0.011)	-0.033*** (0.011)
Senior	-0.032** (0.012)	-0.033*** (0.013)	Rank 3	-0.043** (0.017)	-0.044** (0.017)
Lead	-0.041*** (0.014)	-0.042*** (0.014)	Rank 4	-0.059*** (0.016)	-0.059*** (0.016)
Manager	-0.036** (0.015)	-0.036** (0.015)	Rank 5	-0.052*** (0.017)	-0.051*** (0.017)
Director	-0.031 (0.022)	-0.030 (0.023)	Rank 6	-0.047*** (0.008)	-0.047*** (0.008)
VP	-0.160** (0.081)	-0.161* (0.082)	Rank 7	-0.049*** (0.010)	-0.049*** (0.010)
Head	-0.006 (0.021)	-0.007 (0.021)			
Chief	-0.237*** (0.070)	-0.245*** (0.065)			
<u>Job Function</u>					
Business	0.040*** (0.014)	0.040*** (0.015)		0.040*** (0.015)	0.041*** (0.015)
Data	-0.007 (0.011)	-0.007 (0.011)		-0.008 (0.011)	-0.008 (0.011)
Designer	0.036*** (0.011)	0.036*** (0.011)		0.040*** (0.011)	0.040*** (0.011)
Constant	0.319*** (0.008)	0.329*** (0.010)		0.317*** (0.008)	0.316*** (0.012)
Firm Fixed Effects	Yes	Yes		Yes	Yes
Location Dummies	No	Yes		No	Yes
Observations	1,018	1,018		1,018	1,018

B Appendix: Additional Propositions

All proofs are relegated to the Supplementary Appendix.

B.1 Proposition B.1

Proposition B.1. e_1^* is nondecreasing in x_1 and is nonincreasing in x_2 .

Proposition B.1 says that higher salary cannot reduce a worker's effort, and can only increase it or have no impact. On the other hand, higher salary of one's coworker cannot increase one's effort, and can only decrease it or have not impact. These patterns are hinged on inequality aversion in the salary domain.

B.2 Proposition B.2

Proposition B.2. Let $\Delta y_1 > 0$ be the change in y_1 , e_1^* is increasing in y_1 if $\frac{\Delta y_1}{y_1} > \frac{\alpha_x + \beta_x}{(1 - \beta_x)(1 - \beta_y)}$.

Increasing a worker's equity may not necessarily increase his effort but is guaranteed to increase his effort when the equity change is large enough. Proposition B.2 gives a sufficient but not necessary condition. It is possible for a sufficiently small increase in equity to decrease effort. Since $\frac{\alpha_x + \beta_x}{(1 - \beta_x)(1 - \beta_y)}$ is increasing in α_x and β_x , the equity change is more likely to be large enough when the degree of inequality aversion in the salary domain is small.

B.3 Proposition B.3

Proposition B.3. Let $\Delta y_2 > 0$ be the change in y_2 , then

- (a) $\exists \delta > 0$ such that e_1^* is decreasing in y_2 if $\Delta y_2 \in (\delta, +\infty)$;
- (b) $\exists \delta' > 0$ and $\delta'' > 0$ such that e_1^* is increasing in y_2 if $y_2 < y_1$ and $\Delta y_2 \in (\delta', \delta'')$.

Proposition B.3(a) states that a raise in the coworker's equity reduces the worker's own effort when the raise is big enough. But according to Proposition B.3(b), a raise in the coworker's equity may increase the worker's effort if the worker is in a position with relatively high equity and the coworker's raise is not too big. When a big raise in coworker's equity exacerbates inequality in equity, the worker responds unfavorably due to inequality aversion. On the other hand, if the

equity raise in the coworker's pay mitigates inequality in equity, the worker may respond favorably by providing more effort.

B.4 Proposition B.4

Proposition B.4. *Let $x_2 = x_0$, and let $e_1^* = e_1^0$ when $x_1 = x_2$. Then,*

$$(a) \lim_{x_1 \uparrow x_0} |e_1^* - e_1^0| \geq \lim_{x_1 \downarrow x_0} |e_1^* - e_1^0|$$

(i) if $y_2 > y_1$; or

(ii) if $y_2 = y_1$ and $\alpha_x - \beta_x \geq 2\alpha_x\beta_x$.

$$(b) \lim_{x_1 \uparrow x_0} |e_1^* - e_1^0| \leq \lim_{x_1 \downarrow x_0} |e_1^* - e_1^0|$$

(i) if $y_2 < y_1$; or

(ii) if $y_2 = y_1$ and $\alpha_x - \beta_x \leq 2\alpha_x\beta_x$.

The equalities hold when $\lim_{x_1 \uparrow x_0} e_1^ = \lim_{x_1 \downarrow x_0} e_1^* = e_1^0$.*

Relative to equality in salary ($x_1 = x_2 = x_0$), when a worker's effort responds more to salary raises ($x_1 > x_0$) than to salary cuts ($x_1 < x_0$), we say that inequality in salary has a *positive asymmetric effect* on effort. If the reverse is true, we say that inequality in salary has a *negative asymmetric effect* on effort. The effect is *symmetric* if a worker's effort responds to salary cuts and raises in the same magnitude. Unlike the negative asymmetric effect in the equity domain, Proposition B.4 suggests that the results on the effect of unequal salary are mixed. According to Part (i) of Proposition B.4(a), inequality in salary has either a symmetric or negative asymmetric effect on worker 1's effort when worker 1 has less equity than worker 2. When worker 1 has more equity than worker 2, Part (i) of Proposition B.4(b) says that inequality in salary has either a symmetric or positive asymmetric effect. Part (ii) of Propositions B.4(a) and B.4(b) state that when workers have the same equity, the relationship between advantageous and disadvantageous inequality aversion in the salary domain (α_x, β_x) determines whether there is a positive or negative asymmetric effect. Finally, if e_1^* remains unchanged regardless of equity cuts or raises, then it is trivially true that the effect of inequality in salary is symmetric.

B.5 Proposition B.5

Proposition B.5. *Let $x_2 = x_0, y_2 = y_0$, and let $e_1^* = e_1^0$ when $x_1 = x_2$ and $y_1 = y_2$. Then,*

$$\frac{\lim_{y_1 \uparrow y_0} |e_1^* - e_1^0|}{\lim_{x_1 \uparrow x_0} |e_1^* - e_1^0|} \geq 1 \Leftrightarrow \alpha_x - \beta_x \leq 2\alpha_x \beta_x \Leftrightarrow \frac{\lim_{y_1 \downarrow y_0} |e_1^* - e_1^0|}{\lim_{x_1 \downarrow x_0} |e_1^* - e_1^0|} \leq 1.$$

According to Proposition B.5, relative to general equality ($x_1 = x_2 = x_0, y_1 = y_2 = y_0$), effort responds more to equity cuts ($y_1 < y_0$) than to salary cuts ($x_1 < x_0$) if and only if effort responds more to salary raises ($x_1 > x_0$) than to equity raises ($y_1 > y_0$).

C Appendix: Laboratory Experiment

C.1 Experimental Procedures

Figure C.1 lays out the experimental procedure. Detailed experimental instructions for the control group and the treatment group are available in the Supplementary Appendix.

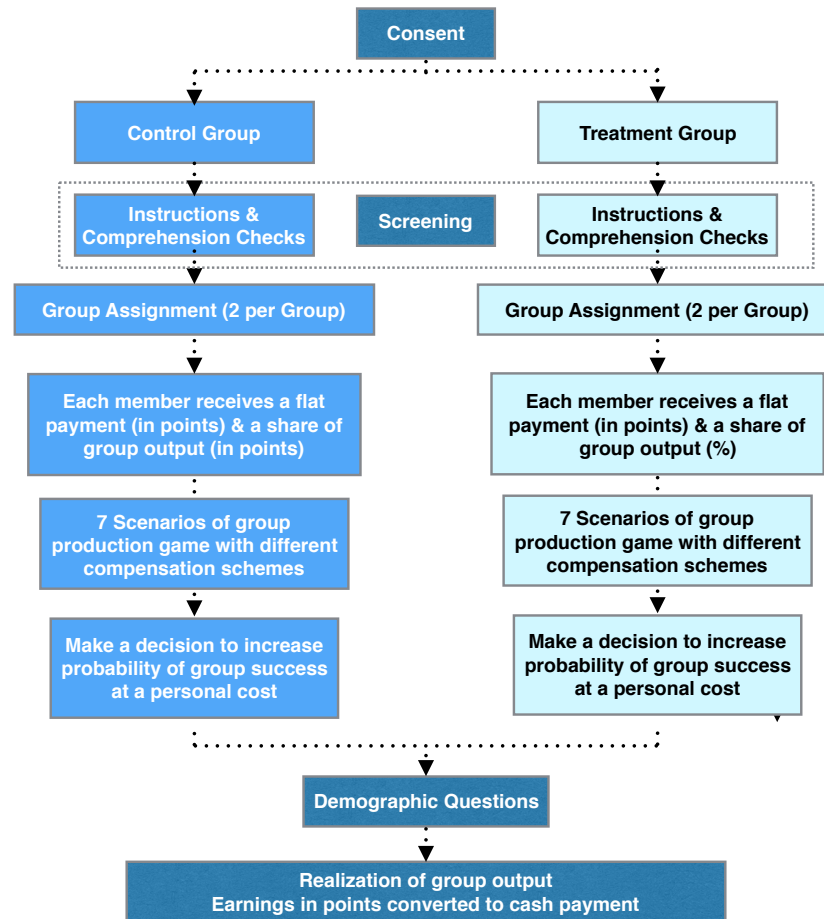


Figure C.1: Experimental Procedures.